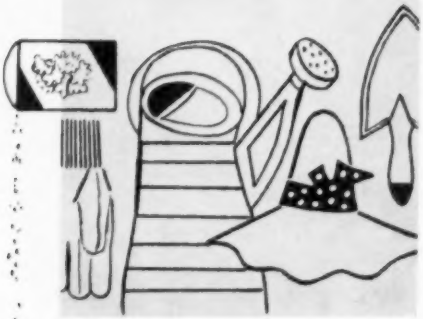
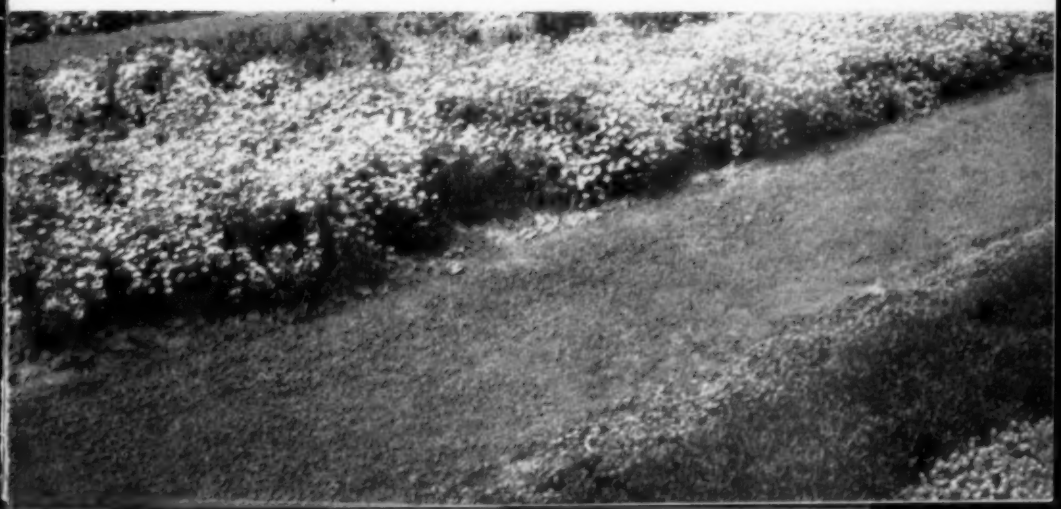
CORNELL EXTENSION BULLETIN 981



Flowers from Seed

by R. E. Lee



Contents

Sowing seed out of doors 3

Cold frames and hotbeds 4

Sowing seed indoors 5
- Cultural requirements 6
- Necessary equipment 6
- Soil mixture 6
- Soil sterilization 7
- Formaldehyde treatment 7
- Commercial disinfectants 8
- Automatic watering methods 8
- Fill the flats or flower pots with soil 9
- Sow the seed 10
- Cover the seed 10
- Burlap covering 10
- Watering 10
- Cultural conditions 10
- Transplanting the seedlings 12
- Use of sphagnum moss 12
- Use of vermiculite 12

Seed difficult to germinate 15
- Stratification 15
- Germinating in a saturated atmosphere 15

A publication of the
New York State College of Agriculture,
a unit of the State University of New York
at Cornell University

JUNE 1957

Flowers from Seed

R. E. Lee

You can easily grow all annuals, biennials and many of the commonly grown herbaceous perennials from seed. This procedure is far less expensive than purchasing established plants, requires no extensive outlay for special equipment, and produces an abundance of plants for the home garden as well as for exchange with others who share similar gardening interests. You can derive both pleasure and satisfaction from growing your own plants from seed.

This bulletin outlines the methods, materials and timing schedules which you can follow to assure maximum success. In all cases it is assumed that fresh seed is used. Although the seed of many species retain viability for more than one year, the highest percentage of germination is obtained from fresh seed.

It is generally advisable to purchase seed from reliable dealers. Seed produced in the garden resulting from pollination by insects or other natural agents may not produce plants typical of the parents. This is especially true of many common garden flowers which are the result of extensive hybridization, such as petunias, oriental poppies, perennial phlox, and the like. Hence there is little value in saving seed from these types.

SOWING SEED OUT OF DOORS

It is usually safe to sow seed out of doors when the maples are coming into leaf in your area. However, if you use cold frames or hot beds, you can start the seed much earlier in the season. Annuals which normally self-sow, such as larkspur, Cleome, and poppies, can be sown in late October. The annuals treated in this manner produce early blooming plants the following spring. Sweet peas and morning glories are best started early in the spring as soon as the soil can be worked. Biennials and perennials can be started any time from early spring up to the middle of July for flowering the following year.

The simplest method of growing plants from seed is to sow the seed directly in the garden where they are to flower. Spade the area, break up the large clumps of soil, and level the surface by raking. You must have good garden loam. If the soil is a heavy clay or is very sandy, your degree of success will be increased if you add liberal amounts of organic matter in the form of compost, well-rotted stable manure, sawdust, peat moss or leaf mold. Work the organic matter thoroughly into the top 4 inches of soil. Sow the seed in rows or broadcast it,

rake the soil so that the seed are covered, and water well. If the seedlings are too crowded when they appear above the soil, thin them out by eliminating the weakest so that the plants are spaced 10 to 12 inches apart. Varieties which are very small at maturity, such as portulaca or sweet alyssum, are best left 6 inches apart. Sweet peas, morning glories and other annual vines, as well as such plants as poppies, which do not transplant well are usually sown directly in the garden.

If you have a specially prepared seedling area apart from the garden proper, sow the seed in rows about 8 inches apart. Space the seed ¼ to ½ inch apart in the row, depending on the size of the seed. The depth of the furrow should also vary according to the size of the seed, ¼ inch deep for small seed up to 2 inches for large seed. Place a garden label or other marker in the row at the beginning and end of each variety in order to assure proper identification later. If the soil is of fine texture, draw it from the sides of the furrow and cover the seed. Otherwise use screened soil. Firm the covering soil over the seed and water well. Until the seedlings are transplanted, check daily to be certain that the soil in the seedbed does not dry out. A light covering of straw or burlap can be used to prevent drying of the surface of the soil but as soon as the seeds begin to germinate, remove the covering. When the seedlings are large enough to handle conveniently, transplant them to their permanent place in the garden.

COLD FRAMES AND HOTBEDS

In central New York State you may sow seed out of doors as early as April 15 in a cold frame or by March 15 if you use a hotbed. Details for constructing the various types of frames and hotbeds are given in Cornell Extension Bulletin 468, *Structures for Starting and Growing Ornamental Plants*.

The procedure in sowing the seed in specially constructed structures is practically identical to that followed when a separate seedling area of the open garden is used. The soil must be of fine texture, should be pulverized or screened, and should be provided with good drainage. If the soil in the frame area is unsuitable, equal parts of garden loam, sand and peat will provide a satisfactory soil mixture for starting the seed.

Sow the seed thinly in rows which are 4 to 6 inches apart. Cover the seed, label the varieties, and water as suggested for outdoor beds. Inspect the seedbed area daily and make certain that the surface soil does not dry out. On warm sunny days you may want to raise the sash during mid-day in order to give ventilation and to prevent temperatures within the frame from going too high. When the seedlings begin to appear above ground, the ideal temperature during the day inside the frame would be 55°F. Seedlings grown at cool temperatures will be sturdier than those grown at high temperatures. As the season advances,

the sash may be removed on warm sunny days and replaced at night, then eventually left off entirely. You can transplant the seedlings to the garden when they are 4 to 6 inches tall or as soon as you can handle them easily and when all danger of frost is past.

SOWING SEED INDOORS

Timing

Plant species vary considerably in the time required for germination of seed and subsequent development. Table 1 provides a guide for timing the sowing of annuals so that the

TABLE 1. TIME TO SOW SEEDS AND TO TRANSPLANT ANNUALS TO HAVE PLANTS READY TO SET IN THE GARDEN THE LAST WEEK IN MAY

Plant	Sow seed in	Transplant seedlings in:
Ageratum	March, third week	April, third week
Amaranthus	April, third week	May, first week
Anagallis	April, first week	April, fourth week
Babysbreath	April, third week	May, first week
Balsam	April, second week	May, first week
Batchelor's button	April, third week	May, first week
Calendula	April, third week	May, first week
California poppy	April, third week	May, first week
Calliopsis	April, first week	April, third week
Candytuft	April, third week	May, first week
China aster	April, second week	April, fourth week
Chrysanthemum	April, third week	May, first week
Clarkia	April, fourth week	May, second week
Cleome	April, third week	May, second week
Cockscomb	April, second week	April, fourth week
Cosmos	April, fourth week	May, second week
Cynoglossum	April, first week	April, fourth week
Dahlia	March, first week	March, fourth week
Dianthus	April, first week	April, fourth week
Dimorphotheca	April, first week	April, fourth week
Gaillardia	April, third week	May, first week
Godetia	April, second week	April, fourth week
Gomphrena	April, third week	May, second week
Hunnemannia	April, first week	April, fourth week
Kochia	April, second week	May, first week
Larkspur	April, first week	April, fourth week
Lavatera	April, second week	May, first week
Lobelia	March, third week	April, third week
Marigold	April, second week	April, fourth week
Mignonette	April, third week	May, first week
Mimulus	April, third week	May, first week
Morning glory	April, third week	May, first week
Nasturtium	April, third week	May, first week
Nicotiana	April, second week	May, first week
Nierembergia	March, third week	April, first week
Nigella	April, first week	April, third week
Petunia	March, third week	April, first week
Phlox	April, second week	April, fourth week
Poppy	April, fourth week	May, second week
Salpiglossis	April, first week	April, third week
Salvia	April, first week	May, first week
Scabiosa	April, third week	May, second week
Schizanthus	April, third week	May, first week
Snapdragon	March, second week	April, first week
Statice	April, first week	April, third week
Straw flower	April, first week	April, third week
Sunflower	May, first week	May, second week
Sweet alyssum	April, second week	April, third week
Verbena	March, second week	April, second week
Vinca	April, first week	April, third week
Zinnia	April, fourth week	May, second week

plants will be sufficiently well established to be set in the garden the last week in May. At that time in central New York State there is practically no danger of frost in a normal season. If you live in a section where the average date of last frost is earlier, as on Long Island, or later, as in the Adirondack region, shift the suggested dates to a correspondingly earlier or later time.

Biennials and many perennials will not flower the first year, so there is no need to start these until mid-April. You may find it easier to care for the seedlings if they are started indoors. Otherwise start them in specially prepared beds out of doors, or in cold frames when space is available after the annuals have been transplanted to the garden.

Cultural requirements

Success in raising seedlings indoors depends upon the availability of optimum cultural conditions. For adequate germination of the seed and development of the seedlings you must provide:

1. *Sunlight*—preferably a window or sunporch with southern or western exposure where sunlight will not be obstructed by curtains.
2. *Temperature* — optimum temperature for the germination of most seed is 68°F. (Larkspur, an exception, germinates best at 55°F.) After germination the temperature should be maintained at approximately 55°F. Temperatures higher than 60°F. will result in weak, spindly seedlings which will be difficult to handle.
3. *Ventilation* — especially on warm days.
4. *Water* — facilities for watering plants often, where water will not damage floors or furniture. The automatic method described on page 8 is recommended.

Necessary equipment

The following items, pictured in figure 1, are the basic requirements:

1. Shallow boxes known as flats (12 by 18 by 3 inches is a convenient size) or flower pots
2. Garden loam, sand and peat moss or leaf mold
3. $\frac{1}{8}$ inch mesh screen (about the same size as window screening)
4. A small piece of board to level the soil
5. Pieces of burlap to cover the flat until germination
6. Wooden plant labels or other permanent markers
7. Wick

Soil mixture

Seed do not require a rich soil for germination, but the soil should be of fine texture, drain readily yet hold moisture. A recommended mixture for seed germination is:

1 part by volume of good garden loam
1 part by volume of peat moss or leaf mold or granulated sphagnum moss
1 part by volume of coarse sand

The materials should be thoroughly worked together and then passed through a coarse screen of about $\frac{1}{4}$ inch mesh. The mixture should then be sterilized.

Figure 1. Equipment

Soil sterilization[1]

Many seedlings are subject to damping-off, a disease caused by fungous organisms common in garden soil. The small seedlings are attacked near the surface of the soil and the stem rots. The plant then topples over. It is, therefore, best to sterilize the soil before it is used. Undoubtedly, the most efficient and convenient way to get sterilized soil is to purchase it from a local florist or nurseryman who has sterilizing equipment. Home sterilization is, however, possible by the following treatments.

Formaldehyde treatment[2]

The formaldehyde treatment has been a standard and effective method of sterilizing soil for many years and has several advantages: anyone can use it; it is inexpensive as the formaldehyde costs less than a cent a flat; it disinfects soil, seed, and flats in one operation; and it does not impair soil texture as does baking and steaming. There are two precautions, however, to follow: (1) Do not use a heavy soil; and (2) if seedlings are to be transplanted into treated soil, spread the soil in a thin layer to aerate and do not use it until you can detect no odor of formaldehyde when a handful is held to the nose.

If no light porous soil is available, a heavy soil must be lightened by mixing half sand and half soil and adding a considerable amount of peat to prevent severe injury to the new seedlings.

Ordinary commercial formalin (40 per cent formaldehyde) is used at the rate of 2½ tablespoons to each bushel of soil or 1 tablespoon to a 20-by-14-by-3-inch flat.

The formaldehyde is diluted with 5 or 6 parts of water. This is sprinkled over the soil and thoroughly mixed in. The treated flats are allowed to stand for 24 hours before seeds are planted

[1] Written in collaboration with A. W. Dimock of the Department of Plant Pathology.

[2] The procedure described is recommended by the Department of Plant Pathology.

in them. After the seeds are sown, the flats should be watered thoroughly.

Muck soil requires 40 percent more formaldehyde than upland or mineral soil. The amounts are 1 2/5 ounces, or 3½ tablespoons, to each cubic foot of muck. This is 1⅞ ounces a bushel. One gallon treats 71 bushels, or 90 cubic feet, of muck while 1 gallon is enough for 100 bushels, or 125 cubic feet, of mineral soil.

Commercial disinfectants

Patented products, available from florist and horticultural supply houses, afford some control for the damping-off disease. Such materials should be used according to the recommendations of the manufacturer.

Automatic watering method

The automatic method of watering has the advantage of supplying a uniform and optimum quantity of water with a minimum of attention. A wick of glass wool (figure 2) extends from the bottom of the flat or flower pot into a pan of water. The water is carried up the wick by capillarity to the soil. If you use flower pots, they should be at least 5 inches in diameter at the top. Prepare the flat by boring

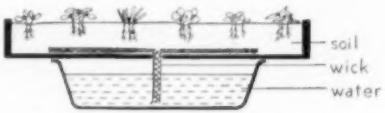


Figure 2. The wick and flat in place

a hole ½ to ⅝ inch in diameter in the bottom through which you insert the wick (figures 2 and 3). One wick is enough for a flat 20 inches square or less. You will need more than one wick for a larger sized flat. Each wick should be approximately 5 inches long. Loosen or fray the wick at one end for a distance of 1½ inches before it is

Figure 3. Inserting the wick in the flat and planting seed

placed through the hole in the flat or flower pot. Insert the wick through the hole so that the frayed end is flattened and forms a circle about 3 inches in diameter, covering the hole and radiating in all directions. Glass wool wicks may be obtained from many florists or horticultural supply houses and are listed in the catalogs of many seed firms.

You can use glass wool wicks for many years, but if you substitute a cloth wick, it will last for but one season. Cloth wicks made from burlap, cheesecloth or similar materials are satisfactory. Take a piece of clean burlap 5 inches long and 3 inches wide and carefully make into a roll 5 inches long by wrapping the burlap with cotton twine from the bottom to within 1½ inches from the top, where the twine is tied firmly (figure 4). At the untied top, slit the burlap in several places so that you can lay back the ends at right angles to the body of the wick. Then place the wick in the flat following the directions given for glass wool wicks. If you use cheesecloth, you will need a piece 5 by 15 inches to give a wick of the desired diameter of ½ inch.

Fill the flats or flower pots with soil

Put the sterilized soil mixture into the flat or flower pot and press well into corners and around the sides. Fill the container to the top and level off without packing the soil. Then firm the soil with a piece of board so that the surface is approximately ½ inch

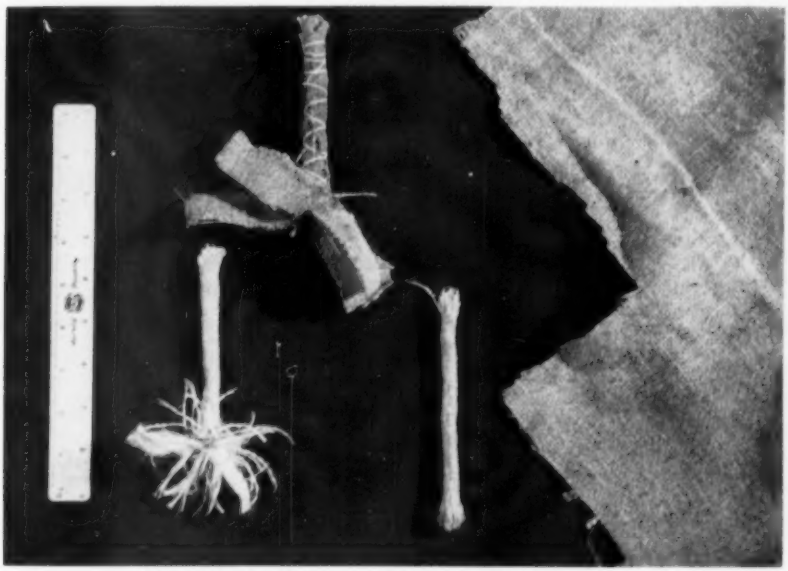


Figure 4. Method of preparing burlap and glass-wool wick

below the edge of the container and you are ready to sow the seed.

Sow the Seed

If you use a flat, mark the surface of the soil with a wooden label to form shallow trenches about 2 inches apart (figure 5, E). In this manner you can keep different varieties separate by sowing one or more full rows to a variety. If you use pots for the seed, simply scatter the seed over the surface of the soil, using one pot for each variety. Whichever container you use, do not sow the seed too thickly, especially if the seed are very small. They should be at least $\frac{1}{8}$ inch apart.

Cover the Seed

Cover the seed so that it is just out of sight, using the same sterilized soil mixture as used for filling the container. Place the soil on the screen of $\frac{1}{8}$ inch mesh and hold 2 or 3 inches above the seed. Work the soil mixture through the screen with the fingers (figure 5, G) until the seed are uniformly and thoroughly covered. Cover a row at a time, or a pot at a time because the larger seed will require a deeper covering than the small. If you try to cover the whole flat at one time by shaking the screen over it, the small seed may be covered too deeply and the larger ones not sufficiently covered.

Burlap covering

After covering the seed with soil, lay a piece of moist clean burlap over the soil (figure 5, H). This will prevent the surface of the soil from drying out and keep the soil from packing or forming a crust. If you do not use the automatic watering method, the burlap will prevent the surface of the soil from washing away when you water the container. As soon as the seed start to germinate, remove the burlap.

Watering

After the burlap is in place, water the flat thoroughly. This can be done by subirrigation: place the flat in a shallow pan with water 2 to 3 inches deep. When the soil is thoroughly watered remove the flat and let it drain, then place it on top of a container of water with the wick extending down into the water (figure 2). An alternative method is to water the flat thoroughly through the burlap covering, using a sprinkling can. Sprinkle until the soil at the bottom is thoroughly moistened. After excess moisture has drained away, set the flat over the container of water if the automatic method is used. Otherwise set the flat in place and check daily, sprinkling as often as needed so that the surface does not dry out.

Cultural conditions

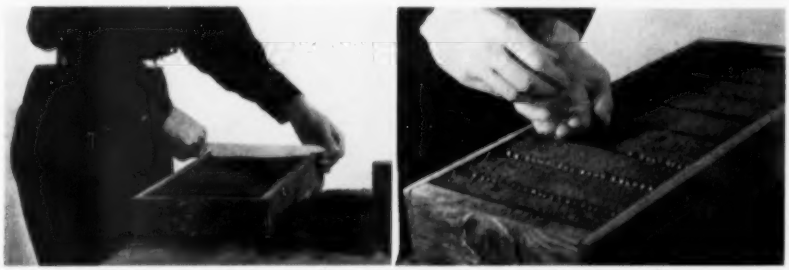
For the first few days or until the seedlings begin to appear, sunlight is unnecessary. The temperature during this period should be approximately 68°F. Just as soon as the seedlings begin to appear, give them full light in a sunny window; otherwise they will tend to grow weak and spindly. If possible reduce the temperature to 55° or 60°F. The closer to this temperature the seedlings are grown, the better they will be.

A. Filling bottom of flat with coarse soil

B. Sifting soil on top of flat

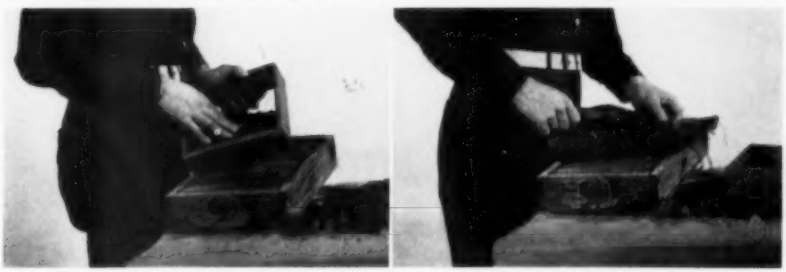
C. Levelling soil with short board

D. Packing soil with short board



E. Making furrows with thin strip of wood

F. Sowing seeds



G. Sifting soil over seeds to cover them

H. Covering flat with burlap

Figure 5. Steps in preparing the seed flat and in sowing seed

Keep the container under the flat filled with water and the soil will remain at the correct moisture content. Inspect the water level every few days to be certain that there is plenty of water available. The soil should never dry out.

Transplanting the seedlings

When the seedlings have developed their first true leaves or are large enough to conveniently handle (figure 6), transplant them to other flats or pots. Space the seedlings about 2 inches apart in each direction.

If a hot bed is available, transfer the transplanted seedlings to it or if there is little danger of severe cold weather, put them in a cold frame. The construction of hotbeds and cold frames is discussed in Cornell Extension Bulletin 468, *Structures for Starting and Growing Ornamental Plants*. If frames or beds are not available and the plants are grown indoors, set them outside each warm sunny day and bring them in at night unless the weather is warm. This will result in strong sturdy seedlings to transplant into the garden.

Use of sphagnum moss

If for any reason the soil and automatic watering method is not convenient, seed can be germinated by using sphagnum moss. This moss grows in some bogs in this section of the country. It can be used fresh or in the dried state as sold by florists and horticultural supply dealers. The advantages of sphagnum moss are fourfold: there is little danger of damping off, there is little danger of overwatering, its use reduces the need for constant inspection to see if it has dried out, and when transplanting seedlings there is less disturbance of roots than occurs when they are transplanted from soil.

Dry sphagnum should be screened through a $\frac{1}{4}$ inch mesh screen. Fresh sphagnum can be shredded by hand or allowed to dry and then screened. When ready to use there may be some strands $\frac{1}{2}$ inch long but most of it should be broken up finer, but not so fine that it is like dust.

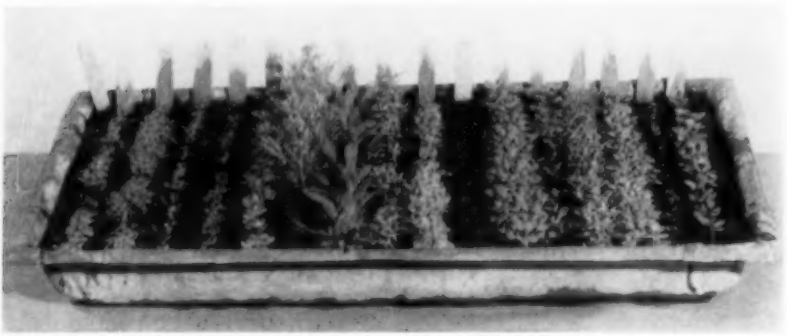


Figure 6. Seedlings ready to transplant

Moisten the moss, fill the flats or pots with the sphagnum so it is level with the top. Water thoroughly until excess water soaks from the bottom of the container, then allow to drain a few minutes. Add a light loose layer of screened sphagnum and sow the seed as outlined for the method using soil. Then screen another light layer of sphagnum over the seed until they are covered and sprinkle lightly with water from a sprinkling can with a fine rose or spray. Until the seed germinate, a pane of glass may be placed over the container to reduce evaporation. Otherwise sprinkle lightly whenever the surface is dry.

There is little nutrient value in sphagnum moss, so if seedlings are to be left in the seed flat any length of time after they are large enough to handle, feed them occasionally with a nutrient solution made by dissolving 5 teaspoons of a 5-10-5 or similar commercial fertilizer in 1 gallon of water.

If the supply of sphagnum is limited, the flat or pot can be half or three-quarters filled with coarse sand and the sphagnum put on top of the sand.

Use of vermiculite

Another satisfactory medium for the germination of seed is the horticultural form of vermiculite. This mica-like material is available from most horticultural supply houses. Use the fine grade and sterilize it by baking in an oven at 350°F. for one-half hour. Vermiculite can be reused many times, but should be sterilized each time before using.

Fill the flat or container to within an inch of the top with vermiculite, water thoroughly, sow the seed by scattering over the surface or by placing them in shallow furrows just as would be done if you were using soil. Cover the seed lightly with vermiculite. If the seed is very fine, such as that of begonias or African violets, you do not need to cover it at all. Put a pane of glass over the flat or flower pot and leave it until the seedlings begin to appear. Be certain that the vermiculite does not dry out at any time. One satisfactory method of insuring this is to sow the seed in pots and place the pots in a saucer of water, keeping the saucer full of water all the time.

Vermiculite is totally devoid of nutrients, so soon after the seedlings appear above the surface it is necessary to give occasional feedings with the nutrient solution mentioned in the discussion of the use of sphagnum moss above.

Annuals that often self-sow and that can be planted directly in the garden in the fall

Calendula
Calliopsis
Centaurea cyanus (Bachelors Button)
Cleome (Spider Flower)
Cosmos
Cynoglossum
Dianthus
Eschscholzia (California poppy)
Gaillardia
Iberis (Candytuft)
Larkspur
Lathyrus (Sweet pea)
Lobularia (Sweet alyssum)
Nicotiana
Nigella
Poppies
Salvia farinacea (Mealy cup sage)
Snapdragon

Perennials that grow easily from seed[1]

Achillea
Aethionema
Ajuga
Alyssum
Althaea
Anchusa
Anthemis
Arabis
Armeria
Artemisia
Aquilegia
Asphodelus
Aster
Asclepias
Aubrieta
Bellis
Bocconia
Boltonia
Campanula
Centaurea
Cerastium
Chelone
Chrysanthemum
Coreopsis
Delphinium
Dianthus
Digitalis
Doronicum
Echinops
Epilobium
Erigeron
Erinus
Eryngium
Eupatorium
Euphorbia
Gaillardia
Geum
Gypsophila
Helenium
Helianthus
Heliopsis
Hesperis
Hibiscus
Hypericum
Iberis
Incarvillea
Inula
Kniphofia
Lamium
Lathyrus
Lavandula
Liatris
Limonium
Linaria
Linum
Lobelia
Lotus
Lupinus
Lychnis
Lysimachia
Lythrum
Malva
Mentha
Mimulus
Myosotis
Nepeta
Oenothera
Onopordum
Papaver
Penstemon
Polemonium
Polygonum
Potentilla
Pyrethrum
Physostegia
Platycodon
Primula (common species)
Rudbeckia
Salvia
Saponaria
Scabiosa
Sedum (common species)
Sidalcea
Stokesia
Tradescantia
Tunica
Valeriana
Verbascum
Veronica
Viola (common species)
Sempervivum
Silene
Solidago
Stachys
Teucrium
Thymus
Trifolium
Yucca

Perennials difficult to grow from seed[2]

Acanthus
Aconitum
Adenophora
Anemone
Arenaria
Arnica
Aruncus
Asperula
Astilbe
Campanula (less common species)
Cassia
Ceratostigma
Cimicifuga
Claytonia
Clematis
Clintonia
Convallaria
Corydalis
Cypripedium
Dicentra
Dictamnus
Dodecatheon
Draba
Dracocephalum
Dryas
Epigaea
Epimedium
Eremurus
Erodium
Filipendula
Gentiana
Globularia
Helianthemum
Helleborus
Hemerocallis
Hepatica
Heuchera
Hosta
Iris (species)
Lewisia
Meconopsis
Mertensia
Monarda
Nymphaea
Onosma
Phyteuma
Primula (rarer species)
Pulmonaria
Ramonda
Ranunculus
Saxifraga
Senecio
Shortia
Thalictrum
Thermopsis
Trillium
Trollius
Wahlenbergia

[1]Applies to the more common cultivated species and assumes fresh seed.
[2]The beginner should purchase nursery-grown plants.

Perennials that do not come true from seed and that should be propagated in some other way

Name	*Common method of propagation*
Anemone (Japanese varieties)	Division and root cuttings
Aster (Michelmas daisy)	Division
Astilbe	Division
Chrysanthemum	Division and cuttings
Convallaria	Division
Gypsophila (only double varieties of G. paniculata)	Grafting
Helenium	Division and cuttings
Helianthemum	Cuttings
Hemerocallis	Division
Iris	Division
Paeonia	Division and grafting
Phlox	Division and cuttings and root cuttings
Primula	Division and leaf cuttings and root cuttings
Saxifraga	Division and cuttings
Sedum	Division and cuttings
Sempervivum	Division and offsets
Solidago	Division
Thymus	Division and cuttings
Veronica	Division and cuttings
Viola	Division and cuttings

SEED DIFFICULT TO GERMINATE

Stratification

The seed of some perennials such as phlox and some species of primroses do not germinate readily unless you subject them to a special treatment which simulates the effect that the winter temperatures have in nature.

This treatment, called stratification, consists of storing the seed in a moist medium for about 3 months at a temperature of 40°F. You can use moist peat moss or sphagnum, filling a small box or container half full with the moss. Then place the seed between layers of cheesecloth so that you do not lose them in the moss and put the cheesecloth on top of the moss. Then continue to fill the container with additional moist moss. Large seed can be mixed with moist moss and put in an airtight polyethylene bag. After the stratification process, sow the seed in the usual manner.

Germinating in a saturated atmosphere

Perennials difficult to grow from seed, such as many of the alpines or rock garden plants, require special handling. The following simple method was developed by R. C. Mott in the greenhouses of the Department of Floriculture and Ornamental Horticulture at Cornell University. You can also germinate fern spores successfully with this treatment.

Mix together thoroughly equal parts by volume of peat moss and washed mason's sand, (washed quartz sand may be substituted). Pack the mixture into a pint Mason jar to within an

inch of the top of the jar. Then cover the surface with a layer ¼ inch deep of coarse white quartz sand.

Pour a weak solution of a fungicide[5] into the jar until the solution floods over the surface of the quartz sand. This will take slightly over a cupful of the solution. Place the cover on the jar and let it stand 48 hours. After this time drain off the liquid, replace the cover and leave for 2 days.

Before sowing the seed put them in a piece of cheesecloth formed into a small bag and dip them in full strength fungicide[5] and dry on blotting paper. Sow fine seed directly on the surface of the quartz sand but cover large seed to a depth approximately half the diameter of the seed. As soon as you sow the seed, replace the cover on the jar so that germination takes place in a saturated atmosphere. No rubber ring on the jar is needed, nor is it necessary to clamp the cover on the jar.

After sowing the seed, put the jars on a windowsill or on a table in front of a window at a temperature of about 68°F. Shade the jars from the direct sun if placed in a south or west exposure. After the second or third day remove the covers for a few minutes, and again when the first leaves appear. Leave the cover on the jar until the seedlings are large enough to handle, then transplant them.

While Mason jars are very convenient, any glass or plastic containers with covers that will prevent evaporation can be utilized. After the seedlings are large enough to be handled, transplant them in the usual manner.

If the seed should be stratified, after sowing place the jars in a refrigerator at 40°F. for 2 or 3 months, then bring out into the light and higher temperature.

[5] For details concerning the fungicide and strength to use, write to the Department of Floriculture and Ornamental Horticulture, Cornell University, Ithaca, New York.

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U.S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.